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ATTORNEYS AT LAW

Docket No.: 243460US6YA

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

RE: Application Serial No.: 10/673,513
Applicants: David L. O'MEARA, et al.
Filing Date: September 30, 2003
For: METHOD FOR MONITORING STATUS OF SYSTEM COMPONENTS
Group Art Unit: 2823
Examiner: William D. COLEMAN

SIR:

Attached hereto for filing are the following papers:

Appeal Brief (with Appendices)

Our credit card payment form in the amount of **$500.00** is attached covering any required fees. In the event any variance exists between the amount enclosed and the Patent Office charges for filing the above-noted documents, including any fees required under 37 C.F.R 1.136 for any necessary Extension of Time to make the filing of the attached documents timely, please charge or credit the difference to our Deposit Account No. 15-0030. Further, if these papers are not considered timely filed, then a petition is hereby made under 37 C.F.R. 1.136 for the necessary extension of time. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

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DOCKET NO: 243460US6YA

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF	:
DAVID L. O'MEARA, ET AL.	: EXAMINER: COLEMAN, WILLIAM D
SERIAL NO: 10/673,513	:
FILED: SEPTEMBER 30, 2003	: GROUP ART UNIT: 2823
FOR: METHOD FOR MONITORING STATUS OF SYSTEM COMPONENTS	:

Appeal Brief Under 37 C.F.R. §41.31

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

This is an appeal from a final Office Action mailed February 14, 2006. A Notice of Appeal was timely filed on May 15, 2006.

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is TOKYO ELECTRON LIMITED having address at 3-6, Akasaka 5-chrome, Minato-ku, Tokyo JAPAN 107-8481.

II. RELATED APPEALS AND INTERFERENCES

Appellants, Appellants' legal representative and the assignees are aware of no appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF THE CLAIMS

Claims 1-56 are pending. Claims 39-56 withdrawn from consideration and Claims 19 and 23 were objected to. Claims 1-18, 20-22 and 24-38 stand finally rejected and are herein appealed.

IV. STATUS OF THE AMENDMENTS

An amendment was timely filed on November 30, 2005. In a Final Office Action mailed February 14, 2006, the Examiner finally rejected Claims 1-18, 20-22 and 24-38. A Notice of Appeal was timely filed on May 15, 2006 along with a Pre-Appeal Brief Request For Review. A Notice of Panel Decision from Pre-Appeal Brief Review was mailed on June 27, 2006 indicating that there is at least one issue for this appeal. The attached Appendix VII reflects Claims 1-18, 20-22 and 24-38 as presently pending on appeal.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

Applicants' invention is directed to a method of monitoring the status of a system component in a batch processing system. As described in the background section of Applicants' specification, various parts of a processing system can include consumable or replaceable system components.[1] Such components can be cleaned or replaced after detrimental processing conditions are detected, or according to a fixed time schedule.[2] However, these maintenance approaches frequently result in overdue or premature cleaning or replacement of the consumable system components, resulting in degradation of process performance.[3] Further, cleaning of the consumable parts and conditioning of the chamber having such parts is typically done for a fixed time period, which may be premature or

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[1] Applicants' specification at paragraph 3.
[2] *Id.*
[3] *Id.*

unnecessarily long.[4] Applicants' invention allows *in situ* monitoring of a system component in a batch type processing system in order to provide more accurate determination of maintenance and conditioning requirements.[5]

For example, as shown in Figure 2a of Applicants' specification, light 223 from a light source is made incident on the system component 200, and light transmitted 221 and reflected 225 from the deposited film 210 is detected. As shown in Figure 2b, the transmitted light 222 and reflected light 226 changes intensity when the material deposit 210 is not present. This provides a mechanism for determining a state of the deposited layer based on threshold light intensities as shown in Figures 7a-7c.

More specifically, Applicants' independent Claim 1 recites a method of monitoring status of a system component in a process chamber of a batch type processing system (generally, Fig. 4; paragraphs 52-59 of the specification). The method includes exposing a system component of the batch type processing system to light (e.g. Fig. 2a, item 223; Fig. 3, item 323) from a light source (step 400 of Fig. 4; paragraph 52). The method also includes monitoring interaction of the light with the system component to monitor a state of a material deposit on the system component in order to determine a status of the system component (Fig. 4, step 402 and paragraph 52; Fig. 3. and paragraphs 49-51).

VI. GROUNDS FOR REJECTION TO BE REVIEWED ON APPEAL

Claims 1-18 and 20-22 and 24- 38 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,762,849 to Rulkens in view of U.S. Patent Publication U.S. 2004/0069225 to Fairbairn et al.

[4] Applicants' specification at paragraph 4.
[5] Applicants' specification at paragraphs 9 and 10.

VII. ARGUMENTS

A. The Cited References Do Not Teach or Suggest Monitoring a System Component

Applicants' Claim 1 reads as follows:

> Claim 1. A method of monitoring status of a ***system component*** in a process chamber of a batch type processing system, comprising:
> exposing a ***system component*** of the batch type processing system to light from a light source; and
> monitoring interaction of the light with the ***system component*** to monitor a state of a material deposit on the system component in order to determine a status of the ***system component***.

The Office Action cites U.S. Patent No. 6,762,849 to Rulkens as teaching all limitations of claim 1 except a batch processing system. Rulkens discloses a system for measuring the thickness of a film deposited on a substrate. As seen in Figure 5 of this reference, the process chamber 32 of Rulkens includes a radiation source 100 for injecting an optical signal into the process chamber. The optical signal is made incident on the substrate 20 and reflected from the substrate to be incident on the interior walls of the process chamber 32. According to Rulkens the interior walls of the process chamber have roughened surfaces that cause light reflected from the wafer to diffusely reflect off the chamber wall such that the light can be collected at a view port 40. The analysis tool 110 collects the light and detects a thickness of the film deposited on the substrate based on the collected light.

Thus, Rulkens discloses monitoring the thickness of a deposited film on a ***substrate***, and not monitoring the status of a ***system component*** as required by Claim 1 of the present application. Indeed, Rulkens does not mention the problem of monitoring and maintaining system components at all.

The Office Action responds to this argument by stating,

> In response to Applicants contention that Rulkens in view of Fairbairn fails to tech a system component, ***the examiner takes the position that since the combined teachings describe forming a layer on a wafer with the wafer being a system component.*** Because the combined teachings teaches

> semiconductor manufacturing (column 1, lines 15-22 [of Rulkens]), ***it would highly suggest that wafer being a semiconductor component*** as defined by Applicant's disclosure. It is well known that a semiconductor wafer will be comprised of the claimed system components, i.e., quartz, silicon, alumina, carbon or silicon carbide (see column 9, lines 46-59 [of Rulkens]).

Thus, the Office Action takes the position that the semiconductor wafer being processed in Rulkens is a "system component" as claimed in Claim 1.

However, it is well established that "[a]lthough the PTO must give claims their broadest reasonable interpretation, this interpretation must be consistent with the one those skilled in the art would reach.[6] Further, "[c]laims are not to be read in a vacuum, and while it is true they are given the broadest *reasonable* interpretation during prosecution, their terms still have to be given the meaning called for by the specification of which they form a part.[7] The outstanding Office Action does not meet this standard.

First, the above-quoted portion of the Office Action points to column 1, lines 15-22 and column 9, lines 46-59 of Rulkens to support its broad interpretation of a processing system component. However, the first of these citations to Rulkens merely mentions the term "semiconductor manufacturing." As to the second citation, this portion of Rulkens describes different types of films that may be deposited on a substrate within the processing system. These cited portions (and the remaining portions) of Rulkens simply do not support an interpretation of "system component" as including a substrate or wafer being processed within the system.

In addition, Applicants specification makes very clear that the "system component" is a component of the processing system, and does not include the wafer or substrate being processed. For example, Applicants specification reads as follows,

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[6] In re Cortright, 165 F.3d 1353, 1358, 49 USPQ 2d 1464, 1467 (Fed. Cir. 1999);
[7] In re Okuzawa, 537 F.2d 545, 548, 190 USPQ 464, 466 (CCPA 1976) citing In re Royka, 490 F.2d 981, 984, 180 USPQ 580, 582-83 (CCPA 1974) ("

> [0041] ... The processing systems in FIGS. 1A and 1B have system components that can erode, can become coated with material deposits, or can have a material deposit removed during processing. ***Consumable system components include process tubes, shields, rings, baffles, liners, and other system components found in batch type processing systems.*** In one embodiment of the present invention, the system components can be manufactured from a variety of materials that are transparent to light. The consumable system components can, for example, contain ceramic materials such as oxides, (e.g., quartz (SiO_2) and alumina (Al_2O_3)), nitrides (e.g., silicon nitride (SiN)), carbides (e.g., silicon carbide (SiC)). A system component can be constructed from a single type of material or, alternately, it can be constructed from more than one type of material.
>
> [0042] ***Processing of substrates in a processing system can form a material deposit on the system component.*** A material deposit can contain one or more types of material, for example silicon (Si), silicon germanium (SiGe), silicon nitride (SiN), silicon dioxide (SiO_2), doped silicon, and dielectric materials including high-k metal oxides such as HfO_2, HfSiOx, ZrO_2, ZrSiOx. Monitoring etch products from the etching of many different material deposits can be unpractical due to a large number of etch products than can require monitoring.
>
> [0043] ***In one embodiment of the present invention, a processing system can include a system component having a protective coating. A protective coating can, for example, protect a consumable system component from the processing environment during a process, and increase the lifetime of the consumable system component.*** A protective coating can be deposited on a system component in-situ, for example during a chamber conditioning process, or, alternately, a protective coating can be predeposited on the system component during manufacturing of the system component. A protective coating can, for example, include SiN, SiC, SiO_2, Y_2O_3, Sc_2O_3, Sc2F$_3$, YF_3, La_2O_3, CeO_2, Eu_2O_3, DyO_3, SiO_2, MgO, Al_2O_3, ZnO, SnO_2, and In_2O_3.

Applicants submit that at least these portions of the specification clearly contrast system components from the wafer being processed. Further, at no point does the specification describe monitoring of the wafer itself. Thus, no reasonable interpretation of system component includes the wafer being processed.

The cited reference to Fairbairn et al. is cited only for its teaching of a batch processing system in general. This reference does not disclose any optical monitoring system, and thus cannot correct the deficiencies of Rulkens. Thus, Applicants' independent

Claim 1 patentably defines over the cited references. As dependent Claims 2-38 depend from Claim 1, these claims also patentably define over the cited references.

B. There is No Motivation to Combine Rulkens with Fairbairn et al.

Even assuming that the substrate being processed is a "system component" as the Final Action asserts, there is no motivation to combine the primary reference to Rulkens with the secondary reference to Fairbairn et al. to arrive at the claimed invention. As noted above, Fairbairn et al. discloses a batch type processing system with no optical monitoring system at all. Rulkens discloses monitoring a single substrate based on light reflected from the substrate surface and scattered by multiple reflections from an interior of the single substrate processing chamber. Applicants submit that such a monitoring system would not work in the batch processing system of Fairbairn et al. because light could not be made incident on the plurality of stacked wafers in the batch processing system. Although light could theoretically be made incident on only a top wafer of the stacked wafers, one of ordinary skill in the art would not be motivated to monitor only one or two wafers of a large batch. Further, reflections from the wafer in a batch processing system would scatter by reflection off not only the interior of the chamber, but also other wafers being processed, therefore altering the properties of the light reflected. In short, where light monitoring of a single substrate is cited for teaching the claimed monitoring of a system component, one of ordinary skill in the art would not be motivated to combine the light monitoring of a single substrate in a batch type processing system, and monitoring of multiple substrates would not be feasible.

Nevertheless, the outstanding Final Action states,

> Rulkens fails to teach a batch type processing system. Fairbairn teaches a batch type processing system. In view of Fairbairn it would have been obvious to one of ordinary skill in the art to incorporate a batch type processing system into the Rulkens semiconductor process because a cluster too [sic]

> configured to batch processing allows multiple wafers to be simultaneously processed in a single chamber.[8]

Applicants submit however that this statement says nothing about combining the features of Rulkens and Fairbairn et al. to arrive at the claimed invention. Thus, the Final Action has not presented a *prima facie* case of obviousness.

C. The features of dependent Claims 2-6, 8, 29 and 30-32 are not disclosed by the cited references.

As discussed above, the Final Action is premised on the substrate to be processed being the claimed "system component." Claims 2-6, 8 and 29 recite characteristics of the claimed system component. However the Office Action cites components other than the semiconductor substrate of Rulkens as having the features claimed in Claims 2-6, 8 and 29. Further the Office Action makes no effort to attribute these claimed features to the substrate of Fairbairn et al. Thus, the characteristics of the system component claimed in Claims 2-6, 8 and 29 provide additional bases for patentability over the cited references.

Finally, Claims 30-32 relate to monitoring the system component based on light transmittance. The Final Action merely concludes that this limitation is met by the cited references, but does not cite any portion of the cited references or provide any explanation of how they monitor transmittance of light through the substrate or any other component. Applicants submit that the cited references also do not meet this limitation. Therefore Claims 30-32 provide additional basis for patentability over the cited references.

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[8] Final Action at page 5, lines 2-7.

D. Conclusion

For the reasons discussed above, the rejection of Claims 1-6, 8, 29 and 30-32 is improper and should be withdrawn.

Respectfully submitted,

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VIII. CLAIMS APPENDIX

Claim 1. (Previously Presented) A method of monitoring status of a system component in a process chamber of a batch type processing system, comprising:

exposing a system component of the batch type processing system to light from a light source; and

monitoring interaction of the light with the system component to monitor a state of a material deposit on the system component in order to determine a status of the system component.

Claim 2. (Original) The method according to claim 1, wherein the exposing comprises:

exposing a system component that is transparent to the light.

Claim 3. (Original) The method according to claim 1, wherein the exposing comprises:

exposing at least one of a process tube, a shield, a ring, a baffle, and a liner to the light.

Claim 4. (Original) The method according to claim 1, wherein the exposing comprises:

exposing a system component including a ceramic material to the light.

Claim 5. (Original) The method according to claim 1, wherein the exposing comprises:

exposing a system component including at least one of an oxide, a nitride, and a carbide to the light.

Claim 6. (Original) The method according to claim 1, wherein the exposing comprises:

exposing a system component including at least one of quartz, Al_2O_3, SiN, and SiC to the light.

Claim 7. (Original) The method according to claim 1, wherein the exposing comprises:

exposing a system component having a material deposit to the light.

Claim 8. (Original) The method according to claim 1, wherein the exposing comprises:

exposing a system component having the material deposit to the light, the material deposit containing at least one of Si, SiGe, SiN, SiO_2, doped Si, HfO_2, $HfSiO_x$, ZrO_2, and $ZrSiO_x$.

Claim 9. (Original) The method according to claim 1, wherein the exposing comprises:

using a laser, a LED, a lamp, or a heater for the light source.

Claim 10. (Original) The method according to claim 1, wherein the exposing comprises:

exposing a system component to light from a light source positioned outside a chamber processing zone.

Claim 11. (Original) The method according to claim 1, wherein the exposing comprises:

exposing a system component to light from a light source positioned inside a chamber processing zone.

Claim 12. (Original) The method according to claim 1, wherein the exposing comprises:

exposing a system component to light having a single wavelength or to light having multiple wavelengths.

Claim 13. (Original) The method according to claim 1, further comprising:

performing a process in the process chamber.

Claim 14. (Original) The method according to claim 13, wherein the performing comprises:

performing at least one of thermal process and a plasma process.

Claim 15. (Original) The method according to claim 13, wherein the performing comprises:

performing at least one of a chamber cleaning process, a chamber conditioning process, a substrate etching process, and a substrate film formation process.

Claim 16. (Original) The method according to claim 13, wherein the performing comprises:

flowing a process gas including a halogen-containing gas during a chamber cleaning process.

Claim 17. (Original) The method according to claim 13, wherein the performing comprises:

flowing a process gas including at least one of ClF_3, F_2, NF_3, and HF during a chamber cleaning process.

Claim 18. (Original) The method according to claim 13, wherein the performing comprises:

flowing a process gas including at least one of a silicon-containing gas and a nitrogen-containing gas during a chamber conditioning process.

Claim 19. (Original) The method according to claim 13, wherein the performing comprises:

flowing a process gas including at least one of DCS and NH_3 during a chamber conditioning process.

Claim 20. (Original) The method according to claim 13, wherein the performing comprises:

flowing a process gas including a halogen-containing gas during a substrate etching process.

Claim 21. (Original) The method according to claim 13, wherein the performing comprises:

flowing a process gas including HF during a substrate etching process.

Claim 22. (Original) The method according to claim 13, wherein the performing comprises:

flowing a process gas including at least one of a silicon-containing gas and an nitrogen-containing gas during a substrate film formation process.

Claim 23. (Original) The method according to claim 13, wherein the performing comprises:

flowing a process gas including at least one of NO and TEOS during a substrate film formation process.

Claim 24. (Original) The method according to claim 13, wherein the performing comprises:

flowing a process gas including a metal-containing gas during a substrate film formation process.

Claim 25. (Original) The method according to claim 13, wherein the performing further comprises:

flowing an inert gas including at least one of Ar, He, Ne , Kr, Xe, and N_2.

Claim 26. (Original) The method according to claim 13, wherein the performing comprises:

exposing a system component to a temperature between about 100°C and about 1000°C.

Claim 27. (Original) The method according to claim 13, wherein the performing comprises:

exposing a system component to a pressure between about 10 mTorr and about 760 Torr.

Claim 28. (Original) The method according to claim 13, wherein the performing comprises:

exposing a quartz system component to chamber pressure of about 200 mTorr and a temperature of about 300°C during a chamber cleaning process.

Claim 29. (Original) The method according to claim 1, wherein the exposing comprises:

exposing a quartz system component including a SiN protective coating and a metal oxide material deposit to the light during a chamber cleaning process.

Claim 30. (Original) The method according to claim 1, wherein the monitoring comprises:

using an optical monitoring system to detect intensity of light transmission from the system component.

Claim 31. (Original) The method according to claim 30, wherein the monitoring further comprises:

determining if an intensity level of the light transmission from the system component has reached a threshold value.

Claim 32. (Original) The method according to claim 31, wherein the monitoring further comprises:

measuring the intensity level of the light transmission component to arrive at a determination of whether to stop the process.

Claim 33. (Original) The method according to claim 1, wherein the monitoring comprises:

using an optical monitoring system to detect intensity of light reflection from the system component.

Claim 34. (Original) The method according to claim 33, wherein the monitoring further comprises:

determining if an intensity level of the light reflection has reached a threshold value.

Claim 35. (Original) The method according to claim 34, wherein the monitoring further comprises:

measuring the intensity level of the light reflection to arrive at a determination of whether to stop the process.

Claim 36. (Original) The method according to claim 1, further comprising:

forming a protective coating on a system component.

Claim 37. (Original) The method according to claim 36, wherein the forming a protective coating comprises:

forming at least one of SiN, SiC, SiO_2, Y_2O_3, Sc_2O_3, Sc_2F_3, YF_3, La_2O_3, CeO_2, Eu_2O_3, DyO_3, SiO_2, MgO, Al_2O_3, ZnO, SnO_2, and In_2O_3.

Claim 38. (Original) The method according to Claim 1, wherein the monitoring comprises:

using an optical monitoring system to detect said interaction of the light; and

purging optical components of said monitoring system with a purge gas.

Claim 39. (Withdrawn) A computer readable medium containing program instructions for execution on a processor, which when executed by the processor, cause a batch substrate processing apparatus to perform the steps of:

exposing a system component of the batch type processing system to light from a light source; and

monitoring interaction of the light with the system component to determine a status of the system component.

Claim 40. (Withdrawn)A system for monitoring status of a system component, comprising:

means for exposing light to a system component in a process chamber; and

means for monitoring interaction of light with the system component to determine a status of the system component.

Claim 41. (Withdrawn) A batch type processing system, comprising:

a process chamber configured to perform a process;

a system component;

a light source configured to expose the system component to light;

an optical monitoring system configured to monitor interaction of the light with the system component to determine a status of the system component; and

a controller configured to control the processing system

Claim 42. (Withdrawn) The processing system according to claim 41, wherein the processing system comprises:

at least one of a thermal processing system, a plasma processing system, a chemical vapor deposition system, and an atomic layer deposition system.

Claim 43. (Withdrawn) The processing system according to claim 41, wherein the system component comprises:

at least one of a process tube, a shield, a ring, a baffle, and a liner.

Claim 44. (Withdrawn) The processing system according to claim 41, wherein the system component comprises a ceramic material.

Claim 45. (Withdrawn) The processing system according to claim 41, wherein the system component comprises:

at least one of an oxide, a nitride, and a carbide.

Claim 46. (Withdrawn) The processing system according to claim 41, wherein the system component comprises:

at least one of quartz, Al_2O_3, SiN, and SiC.

Claim 47. (Withdrawn) The processing system according to claim 41, wherein the system component further comprises a protective coating.

Claim 48. (Withdrawn) The processing system according to claim 41, wherein the system component further comprises a material deposit.

Claim 49. (Withdrawn) The processing system according to claim 41, wherein the system component further comprises a material deposit containing at least one of Si, SiGe, SiN, SiO_2, doped Si, HfO_2, $HfSiO_x$, ZrO_2, and $ZrSiO_x$.

Claim 50. (Withdrawn) The processing system according to claim 41, wherein the optical monitoring system comprises:

at least one of an optical detector to detect light transmission from the system component and an optical detector to detect light reflection from the system component.

Claim 51. (Withdrawn) The processing system according to claim 41, wherein the light source is positioned at least one of inside and outside a chamber processing zone.

Claim 52. (Withdrawn) The processing system according to claim 41, wherein the light source comprises at least one of a laser, a LED, a lamp, and a heater.

Claim 53. (Withdrawn) The processing system according to claim 41, wherein the light source provides at least one of a light having a single wavelength and a light having multiple wavelengths.

Claim 54. (Withdrawn) The processing system according to claim 41, further comprising:

a gas injection system configured to introduce a process gas in the process chamber.

Claim 55. (Withdrawn) The processing system according to claim 41, wherein the gas injection system is configured to introduce a process gas for performing at least one of a chamber cleaning process, a chamber conditioning process, a substrate etching process, and a substrate film formation process.

Claim 56. (Withdrawn) A processing system, comprising:

a process chamber configured to perform a process;

a system component;

a light source configured to expose the system component to light;

an optical monitoring system configured to monitor transmission and/or reflection of light from the system component, wherein the optical monitoring system is further configured to determine if an intensity level of the light transmission and/or light reflection has reached a threshold value, and based on the determination, at least one of continue with and stop the process; and

a controller configured to control the processing system.

IX. EVIDENCE APPENDIX

None.

X. RELATED PROCEEDINGS APPENDIX

None.